REMARKS

Claims 1-18 remain pending in the present application. Applicants greatly appreciate the thorough review of the present application and the indication of allowable subject in dependent claims 12, 13, 15 and 16. Dependent claims 12 and 13 have been rewritten in independent form to include the limitations of dependent claim 9 so that claims 12 and 13 along with claims 14-16, which are dependent either directly or indirectly upon allowable claim 13, are now in condition for allowance. Claims 9-13, 15, 16 and 18 have been amended to address the outstanding objection, to more clearly recite the distinguishing features of the present invention and to improve the form of the claims. Accordingly, reconsideration and allowance of the claims in the present application as amended are earnestly solicited in view of the following remarks.

Claims 10-12, 15 and 16 stand objected for having preambles in an improper form. The preambles of these claims have been amended to be in the proper form. Accordingly, it is respectfully requested that the objection to claims 10-12, 15 and 16 be reconsidered and withdrawn.

Claims 1-6, 8-11 and 18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,458,754 to Sathrum et al. in view of U.S. Patent No. 3,881,126 to Boots et al. This rejection is respectfully traversed.

Claim 1 of the present application recites a cathode sub-assembly comprising an indirectly heated cathode and a support rod fixedly attached thereto. Claim 9 recites a cathode assembly for use in an indirectly heated cathode ion source comprising a cathode sub-assembly, a filament and a cathode insulator. Claim 18 recites a cathode assembly for an ion source comprising a cathode, a support rod, a cathode insulator and an indirect heating source. The indirectly heated cathode is electrically and thermally isolated from its surroundings to promote emission of electrons from the ion source.

Sathrum et al. is relied upon to disclose a plasma guide for physical vapor deposition. A source of coating material 15 represents the origin of plasma for the vapor deposition coating process and a cathode mounting apparatus 16 as illustrated in Fig. 1. As acknowledged in this Office Action, Sathrum et al. directly heats the cathode and fails to disclose indirectly heating the cathode as recited in the claims of the present applcation. Therefore, Boots et al. is relied upon in attempting to cure this deficiency. Boots et al. disclose a fast warm up cathode comprising a coiled heater 17 wrapped about an elongated core 12 to provide heating thereof. However, Boots

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et al. do not disclose an indirectly heated cathode ion source that is electrically and thermally isolated from its surrounding to promote emission of electrons. Because Boots et al. fails to cure the deficiencies of Sathrum et al., it is respectfully submitted that claims 1-6, 8-11 and 18 of the present application patentably define over the combination of Sathrum et al. and Boots et al.

Claim 7 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Sathrum et al. in view of Boots et al. and in further view of U.S. Patent No. 3,917,968 to DiBenedetto et al. This rejection is respectfully traversed.

Dependent claim 7 recites that the cathode sub-assembly further comprises a spring loaded clamp for holding the support rod. DiBenedetto et al. is relied upon to disclose that a thermionic filament for generating the electrons are mounted by means of resilient support means in the form of spring member. In addition to the reasons set forth in the rejection to its base claim, DiBenedetto et al. do not disclose a spring loaded clamp for holding the support rod of the indirectly heated cathode as recited in claim 7 of the present application. Accordingly, it is respectfully submitted that claim 7 patentably defines over the combination of Sathrum et al., Boots et al. and DiBenedetto et al.

Claim 17 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Sathrum et al. in view of U.S. Patent No. 3,983,443 to Schade. This rejection is respectfully traversed.

Claim 17 of the present application recites a method for supporting and indirectly heating a cathode of an ion source comprising the steps of supporting the indirectly heated cathode and bombarding the cathode with electrons. The indirectly heated cathode is electrically and thermally isolated from its surroundings to promote emission of electrons. As acknowledged in this Office Action, Sathrum et al. fails to disclose a method for indirectly heating the cathode as recited in the claims of the present application. Therefore, Schade is relied upon in attempting to cure this deficiency. Schade discloses a heater cathode assembly for a vacuum electron device that may be used in television picture tubes. However, Schade does not disclose an indirectly heated cathode ion source that is electrically and thermally isolated from its surrounding to promote emission of electrons. Because Schade fails to cure the deficiencies of Sathrum et al., it is respectfully submitted that claim 17 of the present application patentably defines over the combination of Sathrum et al. and Schade.

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In view of these amendments and for all of the above stated reasons, it is respectfully submitted that all of the outstanding objections and rejections have been overcome. Therefore, it is requested that claims 1-18 of the present application be passed to issue.

If any issues remain unresolved, the Examiner is requested to telephone the undersigned attorney.

Please charge any additional fees or credit any overpayments to deposit account No. 50-0896.

Respectfully submitted,
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MARKED-UP CLAIMS

9. (Amended) A cathode sub-assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode and a support rod fixedly mounted thereto; ~~and~~

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and

a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing, that is disposed around the cathode of the cathode sub-assembly.

10. (Amended) The cathode ~~sub~~-assembly as defined in claim 9 further comprising a filament disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber.

11. (Amended) The cathode ~~sub~~-assembly as defined in claim 9 further comprising a filament disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber, wherein the filament is fabricated of an electrically conductive material and includes an arc-shaped turn having an inside diameter greater than or equal to the diameter of the support rod.

12. (Amended) ~~The~~ A cathode ~~sub~~-assembly ~~as defined in claim 9 further~~for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode and a support rod fixedly mounted thereto;

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly;

a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing, that is disposed around the cathode of the cathode sub-assembly; and

a filament disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber, wherein the filament is fabricated of an electrically conductive material and includes an arc-shaped turn having an inside diameter greater than or equal to the diameter of the support rod, and wherein a cross-sectional area of the filament varies along a length of the filament, and is smallest along the arc-shaped turn.

13. (Amended) ~~The~~ A cathode assembly ~~of claim 9~~ for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode and a support rod fixedly mounted thereto;

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and

a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing, that is disposed around the cathode of the cathode sub-assembly;

wherein said cathode insulator includes an opening having a diameter that is larger than or equal to the diameter of the cathode.

15. (Amended) The cathode ~~insulator~~ assembly of claim 13 wherein said cathode insulator has a generally tubular shape with a sidewall and includes a flange, for shielding the sidewall of the cathode insulator from a plasma in the arc chamber.

16. (Amended) The cathode ~~insulator~~ assembly of claim 15 wherein said flange is provided with a groove on a side of the flange facing away from the plasma, for increasing a path length between the cathode and the arc chamber housing.

18. (Amended) A cathode assembly for an ion source comprising:

a cathode;

a support rod fixedly attached to the cathode; ~~and~~

a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing; and

an indirect heating ~~means~~ device for indirectly heating the cathode.